SOLENOIDAL SKIN VIBRATOR ENERGIZED BY COMPLEX ELECTRIC WAVEFORMS

This application is a complete application based on Provisional Patent Application Ser. No. 60/088,619 filed Jun. 9, 1998.

BACKGROUND OF THE INVENTION

The field of the invention pertains to vibrators that stimulate the skin and underlying tissue for medicinal treatment or for sensual pleasure. In particular, the invention pertains to small hand held electric massagers and vibrators that are held against the skin for treatment or pleasure.

Heretofore, electrical and mechanical skin vibrators have been designed to operate at a single constant amplitude and frequency or, with selection means, at any one of several preset constant amplitudes and frequencies. Thus, the user could adjust the frequency and amplitude to a different setting if desired, however the choice of settings was limited and unmodulated.

SUMMARY OF THE INVENTION

The new skin vibrator converts simple or complex electrical waveforms into simple or complex mechanical waveforms or vibrations that are applied to the skin and underlying tissues. The complex waveforms may be completely random in response to the output of a random electrical noise generator, or non-random but complex in response to music or speech. In effect, random acoustic vibrations or musical vibrations are induced in the skin and underlying tissue.

The new skin vibrator comprises a generally tubular or oblong hollow body closed at one end. Adjacent the closed end is an electric solenoid having a relatively heavy permanent magnet solid rod within the solenoid. The solid rod is free to move back and forth along the solenoidal axis but is constrained to remain within the solenoid by resilient partial damping means at each end of the solenoid. The damping means also contact the inside wall of the tubular body.

Attached to the solenoid are a pair of wires leading from the tubular body open end and connected to a signal generator or loudspeaker electric driver output. In an alternative embodiment the body is oblong and closed at both ends with the wires exiting the body at one end.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates the assembly of the tubular vibrator in exploded view;

FIG. **2** illustrates in cross-section the final assembly of the vibrator;

FIG. **3** illustrates in cross-section the assembled vibrator;

FIG. **4** illustrates an alternative oblong construction of the vibrator; and

FIG. **5** illustrates a second alternate embodiment of the vibrator.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Illustrated in FIG. **1** is a first tube **10** having a closed end **12** and an open end **14**. Inserted into the tube **10** as indicated by arrow **16** is an electromechanical motor in the form of a solenoid generally denoted by **18**. The solenoid comprises a solenoid tube **20** electrically wound **22** to cause a solid cylindrical permanent magnet **24** therein to reciprocate within the solenoid tube.

Capping each end of the solenoid tube **20** is a pair of foam plastic discs **26**. The foam plastic discs **26** prevent the magnet **24** from directly contacting the inside wall of the tube **10**. The foam plastic of the discs **26** is selected to partially damp the transmission of the reaction forces communicated from the solenoid tube **20** to the first tube **10**.

As shown in FIG. **2** the solenoid **18** is located adjacent the tube end **12** with the discs **26** wedging the solenoid tube **20** transversely inside the first tube **10**. The electric winding **22** includes a pair of wires **28** extending from the first tube **10**. The wires **28** extend through a foam tube **30** which fits inside the first tube **10** as indicated by arrow **32**.

The final assembly of the vibrator is shown in FIG.3. The wires **28** may be connected to an electric signal generator **29** or output of an audio amplifier such as a loudspeaker driver circuit. Other alternatives may be the radio speaker driver circuit output such as from a car radio or portable transistor radio. As a further alternative a battery powered random or programmed solid state signal generator or a radio may be built into the interior of the foam tube **30** as illustrated at **31** in FIG. **2**. In any of these versions the signal generator could be used to induce standing waves of known amplitude and frequency for medical diagnosis and therapy. Also the foam tube **30** may be constructed of foam plastic sponge and left open for insertion of a finger or other bodily appendage.

In constructing the electric winding **22** one end is wound clockwise and the other end is wound counterclockwise as shown in FIG. **3** with the magnet **24** axially magnetized. Thus, the magnet **24** is caused to reciprocate in response to the electromagnetic signal imposed thereon without settling into a neutral position.

Illustrated in FIG. **4** is a modification of the external body of the vibrator wherein the solenoid tube **20**, magnet **24** and winding **22** are covered by a pair of end covers **34** forming an egg shaped cover over the solenoid driver. Either of the end covers **34** may be used to contact the skin. The wires **28** exit the vibrator at the joint **36** between the end covers **34**. As above the foam discs **26** wedge the solenoid **18** against the insides of the end covers **34** to transmit partially damped vibrations to the end covers generally in the direction of the major axis of the vibrator. Returning to FIGS. **1** through **3** the solenoid **18** may be positioned for axial movement of the magnet **24** relative to the tube **10** as an alternative to transverse movement.

In FIG. **5** a further alternate embodiment of the vibrator is illustrated as a series of assembly steps. As shown the magnet **24** is inserted in the solenoid tube **20** which is wound for reciprocating movement. The solenoid **18** is then positioned between the two foam discs **26** and this assembly is inserted into the end covers **34** with the wires **28** extending through one end cover. The other end cover **34** has permanently attached thereto a hollow appendage **38** having a hemispherical closed end **40**. Application of an electrical signal from a signal generator **29** or other source as explained above will cause vibration of the device, in particular, the appendage **38**. The appendage **38** is angularly offset from the major axis of the end covers **34** to impart some transverse vibration to the appendage from axial movement imparted by the solenoid **18**.

What is claimed is:

1. A skin vibrator comprising an oblong tubular hollow body, an electromechanical solenoid in the hollow body and positioned to impart a complex mechanical vibration to the hollow body in response to a complex electrical signal applied to the solenoid and damping means communicating with the hollow body and the solenoid to soften the complex mechanical vibration imparted to the hollow body,